OXYGEN

Molecular formula

O_2

Physical properties

Specific Gravity:	1.050
Melting Point:	–218.4°C
Boiling Point:	–183.0°C

Colourless, odourless gas. Stored under pressure in cylinders. Supports the combustion of fuels.

Oxidising agent. Promotes fierce burning. Air contains about 21 percent oxygen. An increase to 23 percent or higher concentrations of oxygen may cause the burning of materials which do not usually burn. High pressure oxygen may cause materials to ignite without apparent source of ignition. May react explosively with oil and other hydrocarbons when under pressure.

End uses

There is no substitute for oxygen in any of its uses. It cannot be reclaimed or recycled except via the atmosphere.

A major industrial use for oxygen is in steel making where it purifies liquid iron in a furnace (the basic oxygen furnace) to produce steel by oxidising the principal contaminants eg carbon, sulphur, phosphorous, silicon and manganese which can then be readily removed.

Oxygen is also used in the smelting of copper, lead, antimony and zinc.

Chemical manufacturing is also a large user of oxygen. Ethylene may be oxidised either directly to ethylene oxide or to acetaldehyde and then to acetic acid. The oxidation of ethylene yields an enormous range of organic chemicals.

In the pulp and paper industries, oxygen is needed to burn the lime necessary to prepare or reconstitute the white liquor. It may also be used to dilignify and bleach wood chips, increasing the quality and the yield of the pulp.

Oxygen also has many uses in medical and life support applications (eg high altitude, underwater uses).

Production process

Commercial oxygen is produced by the fractionation of air in units where air is cleaned, dried, compressed and refrigerated until it partially liquifies. It is then distilled into its components.

The ambient intake air is cooled and cleaned, either by freeze out reversing exchangers or by standard exchangers with air purification. The choice of processing technique depends upon the total output of pure oxygen and nitrogen expected from the unit.

Most trace impurities arising from air pollutants are either frozen out and trapped in the reversing exchangers or are removed together with water and carbon dioxide by adsorption on certain solid agents. All modern plants include silica–gel absorbers where it is particularly effective in removing acetylene, a major cause of explosions of other hydrocarbons concentrated in the liquid oxygen.

Handling

Oxygen is classified as a 2.2 (non flammable gas) and 5.1 (oxidising agent) Dangerous Substance for the purpose of transport. Refer to State Regulations for storage and transport requirements.

Not to be loaded with spontaneously combustible substances (Class 4.2), organic peroxides (Class 5.2), flammable gases (Class 2.1), poisonous gases (Class 2.3), flammable liquids (Class 3), flammable solids (Class 4), poisonous substances (Class 6) corrosives (Class 8), miscellaneous dangerous substances (Class 9) or substances capable of being ignited.

Store in a cool place and out of direct sunlight. Store in well ventilated area away from sources of heat or ignition. Store away from organic and/or combustible materials. Check regularly for leaks.

Spills

Shut off all possible sources of ignition. Stop leak, if possible and safe to do so. If leak cannot be stopped move oxygen cylinder to a safe area outdoors and allow to empty. Alert emergency services and cylinder supplier.

Disposal

Allow to vent to atmosphere. Close valves on empty cylinders and return to supplier.

Safety data

The short term exposure to oxygen by all means is considered practically non-harmful.

Oxygen is a normal constituent of air, however at pressures above 1 atmosphere it is a poison and will affect the central nervous and respiratory systems. Exposure to a 4 atmosphere pressure of oxygen at atmospheric pressure can cause respiratory irritation and pulmonary oedema is after 24 hours exposure. However, industrial exposure to high oxygen pressure is uncommon.

First aid

Remove victim from exposure—avoid becoming a casualty. Loosen clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered.

Attachment

Oxygen production process

Orica Limited
February 1991

AIR SEPARATION PLANT: PROCESS FLOW DIAGRAM